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## ARTICLE VIII.

*Notice of Fossil Arborescent Ferns, of the Family of Sigillaria, and other Coal Plants, exhibited in the Roof and Floor of a Coal Seam, in Dauphin County, Pennsylvania, by Richard C. Taylor, F. G. S. &c. Read May 30th, 1843.*

I AM desirous of placing on record a description of certain remarkably developed specimens of vegetable fossils, of great magnitude, which have come under my observation, in the most southern of our Pennsylvania Coal Fields. It is not often that presentations, on such a scale, can be studied so advantageously as in the present instance. I willingly admit, that they merit description from a much more accomplished naturalist than myself.

Those now about to be described are, or were, displayed during the progress of working a Gallery or Drift, several hundred feet in length,\* in a Coal bed to which the name of "Perseverance Vein" has been given. Its position is towards the western extremity of the Schuylkill Coal Field, thirteen miles east from the Susquehanna River.

I should have felt less disposition to enter upon this task, had detailed descriptions of interesting exposures of coal vegetation, on an enlarged scale,—acquired during the progress of practical operations, in our mines,—been more frequently furnished to science. For illustrations of this instructive character, we in vain search among authorities which are recognised as of the very highest scientific reputation. Their specimens, selected for illustration, generally represent but a minute section, a mere fragment of these gigantic plants, and are limited to the exhibition of the characters of their bark or of their leaves. But these samples transmit to us no conceptions of the actual scale, the true magnitude, to which this magnificent flora attains; any more than a single brick conveys an adequate idea of the architecture of a building.

M. A. Brougniart, himself the author of a standard treatise on fossil vegetables, became fully aware of the necessity for calling the geologists to his aid; ere he could perfect the splendid work which he has communicated to the scientific world.† "No one knows better than myself," he exclaims, "the difficulties inherent to such a subject, and the imperfections, impossible to avoid, which may be found in the work which I publish. This work will present only the first rough sketch of the vegetation of the ancient world;

\* Length of excavation, five hundred and fifty-eight feet.

† Histoire des Végétaux Fossiles par M. Adolphe Brougniart.

and it will be still many years before we can trace a more perfect picture. To achieve such a result, it is necessary that the geologists and the botanists should unite their efforts; in order that none of the objects, requisite to enlighten a subject so difficult, should be neglected."

It rarely happens that the persons who are practically employed in coal mines regard the fossil flora by which they are surrounded, as in a museum, with sufficient interest to take adequate note of the natural objects which, from time to time, present themselves. In fact they are, from obvious circumstances, unfitted for observation; or rather, for noting, with that degree of precision that commends itself to our confidence.

Upon the geologists, but more especially upon those among them who direct the explorations of our mines, the charge mainly devolves of observing and recording the phenomena of fossil vegetation, as they are brought to view from the depths and darkness of the earth. Upon these instructed observers, rests the interesting duty of communicating intelligence respecting those long buried productions of nature, which they have assisted in developing, on a magnificent scale, within the galleries and the recesses of the mine.

However elaborately these specimens may, at first, be displayed upon the walls of our coal veins, those who are practically engaged there, well know how soon those relics are defaced or despoiled of their freshness and beauty, by the operations which are there incessantly carried on by the miner and his assistants. Sensible of this, and with a view to the preservation, upon paper at least, of the magnificent memorials which I am about to describe, I have made it a special object, during upwards of a year, to trace out on the most extended scale that the works permitted; to make admeasurements; to preserve specimens; and to take drawings, from day to day, as the excavations proceeded and the fossils were laid bare, of whatever details might afford instruction relative to the character of this ancient flora. The result of this labour is now before the present meeting.

The coal of the bed in question is in the transition state, often denominated semi-bituminous: that is to say, it contains upwards of sixteen per cent. of volatile matter.\* Its position is highly inclined; dipping not less than seventy degrees to the north. Several other smaller coal seams occur in this locality, (the Third or Sharp Mountain,) alternating with a countless series of conglomerates, grits, sandstones, argillaceous shales, and fire clay: all inclining northward, at from seventy to seventy-nine degrees. Nearly every one of the numerous coal seams we have explored in this quarter,—often very small and consequently unprofitable for working,—has a floor of soft slate or fire clay, and a roof of coarse siliceous conglomerate. This fact is distinctly exhibited in the two sections, and in the ground plan, which accompany this memorial.† The conglomerate or pudding-stone, spoken of, is compact and dense: it is extremely difficult to blast, and

* Proportions of Carbon,	76	10
Volatile matter,	16	90
Ashes,	7	00
	<hr/>	
	100	00
Specific Gravity,	1	391

† It has only been found practicable, consistent with the arrangements of the Society on the present occasion, to admit of one engraved illustration, of a part of the diagram exhibited by the author to the meeting.

consequently is very expensive to operate in; as all know, to their cost, who have had to pass through it, by drifts or shafts.

The direction or level course of this vein, in the gangway, is from  $19^{\circ}$  to  $25^{\circ}$  to the northward of east; that is to say, commencing in a course north  $64\frac{1}{2}$  east, it sweeps round to north  $71^{\circ}$  east. It will be sufficient for our purpose, when speaking of bearings, to limit our description simply to the cardinal points.

Between the north and south walls the interval is eight or nine feet: of which space five and a half feet consist of coal, divided in the midst by a seam, two or three feet thick, of fire clay. Along the course, therefore, of this coal seam, and bounded by its walls, the exploratory gallery has been pursued. With so high an inclination as seventy degrees, these walls are not unsuitably disposed for the purposes of the mine; and are especially adapted to the display of the vegetable fossils, which appear like pictures suspended from a wall, on either hand.

I have said thus much in explanation of local details, because, without them, our position could not be understood.

It has been stated that all the principal coal seams, known to me in this vicinity, have floors of argillaceous matter, called the "bottom slate," and roofs of conglomerate rock. In the present instance these lower slates, comprising two thin seams of coal and some thin beds of argillaceous sandstone, are seventeen feet thick, before reaching the next conglomerate, on that side. Turning to the north, the bare wall of conglomerate forms the hanging side of the coal seam, without any separating matter between it and the coal, except from two to four inches of shale, called by the miners the "top slate." This is commonly stripped down in the process of excavating the coal; as the slate here parts more readily from the rock, than the coal separates from the slate: moreover the solid rock forms a safer wall than does the loose shale. Occasionally, as in other veins we have traced, the conglomerate even comes in contact with the coal itself; exhibiting the form of the coal vegetation upon its under surface; and, notwithstanding the coarseness of the materials of this rock, may be often seen moulded into the configuration of the larger plants, which even retain their carbonized bark.

The irregular space between the actual serviceable coal and its overlying pudding-stone, is almost entirely occupied with casts of trunks of trees, lying horizontally; that is to say, parallel with the coal.

These preliminary explanations will, I think, render the position of an observer in this gallery, sufficiently intelligible. As he advances forward, towards the east, he has the clay floor of the coal seam, on his right hand, sloping at a high angle towards the north; while on his left, facing the north, the conglomerate roof, or hanging wall, approaches within twenty degrees of the perpendicular. As in every case within my knowledge, the upper surface of the coal and the inferior surface of the overlying rock, are somewhat rough and irregular, forming a remarkable contrast to the lower surface of the same coal, and to the smooth and almost polished face of the subjacent slate. When the circumstances which attended the slow and tranquil accumulation of the one, and the turbulent and disturbed condition of all things at the commencement of the other, are taken into consideration, we shall obtain a ready explanation of the irregular surfaces of all coal seams which have conglomerate roofs.

## THE SOUTH OR BOTTOM WALL.

After removal of the coal, the slate floor presents a perfectly beautiful picture of plants and compressed trunks of large trees; mostly in a well preserved state. Until the face of this southern wall has become obscure by the coal, mud, and dirt which rapidly accumulates in these thoroughfares, under the operations of the miners, this exhibition is singularly interesting; and furnishes abundant opportunities for the study of fossil botany.

The coal vegetation, thus favourably presented, belongs, in a great measure, to the class *Sigillaria*, which plants are allied to the family of arborescent ferns. Of these *Sigillaria*, or tree ferns, we think we can, with some degree of probability, distinguish five or six distinct species. One other species, also, apparently a *Sigillaria*, is particularly abundant. Its bark, now carbonized, is at least one third of an inch in thickness. This being removed, the inner surface resembles somewhat the *Syringodendron organum* of Sternberg, (Tab. xiii.) although this is not an uncommon character among the thick-barked varieties. Its longitudinal grooves or striæ are rather irregular, but average half an inch in breadth. The outer bark is roughly marked with an obscure and coarse tissue, and exhibits no distinct cicatrices.

Of the family of *Syringodendron*, which also has been classed with the *Sigillaires*, we have apparently one species: of the *Lepidodendron* of Sternberg, two species; of *Stigmara*, one species. From the shales of the outcrop of the vein, we derive two or three species of *Neuropteris*; three of *Pecopteris*; two of *Sphenopteris*, and one of *Calamites*.

This list is evidently incomplete; and it forms no part of my present undertaking to prepare more than a sketch of the subordinate class of fossil plants.

Among all these, as we have already intimated, the family of *Sigillaria* is the most conspicuous, and occupies by far the largest space. These gigantic plants are all placed horizontally; that is to say, parallel to the stratification. They seem to have sustained no injury, except such as might accrue from being flattened under great pressure; while the soft clay or argillaceous matter in which they were immersed, has evidently tended to their preservation. These stems are of very large size, as is shown by the accompanying drawing. They cross each other in every direction, and form no inconsiderable part of the mass of clay or mud, on and in which they repose. Among the most remarkable and beautiful of these fossils, is a bifurcated species, whose stems and branches are uniformly bent, or curved. We think we recognise in this species the *Sigillaria elegans* of M. Brongniart. These are somewhat abundant here, and we have met with still more splendid specimens of the same species,\* in the imperfect coal and coal shales below the upper red shale. On account of the obscurity of the cicatrices in those before us, baffling specific discrimination, it may possibly be *Sigillaria Knorrii*, (Tab. 156,) which so nearly resembles it; but the probabilities seem to favour the *Sigillaria elegans*; the scaly markings of which are smaller and more closely approaching to our specimens. A further reason for this preference is, that the *elegans* is dichotomous, and we have no evidence that the *Knorrii* is.

\* I speak here from memory, as these fine specimens were subsequently destroyed by fire.

The oblique position in which, for the most part, these enormous stems of *Sigillaria* are disposed, in the floor or south wall of the coal seam, is unfavourable for determining their longitudinal extent: nor shall we ever ascertain it, until a much larger area is uncovered. During the length of several hundred feet in this gallery, not a single case is presented, either of the commencement or the termination of a stem of *Sigillaria*. With the exception of the one flexuous dichotomous species, mentioned above, the whole are singularly straight, and present no apparent diminution of their breadth, towards their superior extremities. Five or six of these *Sigillaires* have thirty feet of their length laid bare; and one other has forty or fifty feet long, exposed; without any perceptible change in width during that space. We regret the necessity of leaving so much undetermined. The actual lengths of these noble trunks can only be ascertained whenever, in the future operations of the mine, the coal shall be more extensively removed.

More than one hundred of these straight *Sigillaria* are shown in our drawing. These are only the best defined among them; selected for illustration. At least double that number exist in that space; but there would have been no advantage gained by introducing them into our sketch. As to their thickness, it may be stated that few stems are so small as two feet wide: many are three feet diameter: four or five of them are four feet; one or two others are four and a half feet; and two are five feet broad, each: differing little, probably, from the original thickness of the living trunks. All these may be verified by consulting our diagram; which was drawn to a scale, from the actual admeasurements of the stems, at the time of discovery.

The exterior or epidermal, and the cortical covering, are in these specimens converted into coal. This carbonizing process, during the imperfect crystallization of the coal, tends greatly to ambiguity; for by this circumstance we are deprived of the only certain mode to which we can resort for determining species. The obscurity, occasioned by this modification of surface, has added to our embarrassments in examining these fossils, and has occasioned no slight hesitation in establishing their specific identity. Where the thickness of bark is considerable, as in *Sigillaria pachydermata* of Brongniart, and the *Lepidodendron rimosum* of Sternberg, the characteristic marking of the cicatrices, when converted to coal, is nearly obliterated. In the case of the species before alluded to. *Sigillaria elegans*, the carbonized bark appears to be only one twenty-fifth part of an inch thick; and, when removed, shows that the inferior surface still bears a modified resemblance to the outer covering.

It seems highly probable that a large proportion of the bulk of the coal itself was derived from the stems and leaves of *Sigillaria*; for by the appearances which yet remain, they must have stood as thickly crowded, as any of our most densely wooded forests. M. Brongniart has stated that the great number of leaves which the *Sigillaires* bore, extending along their entire length, and which had evidently been disarticulated and had fallen before the stem was buried in the strata, announce a life of no ordinary duration, and a growth which has required a considerable lapse of time. Notwithstanding this, we observe that the inferior extremity of the trunk presents flutings and cicatrices, which agree, as to size, with those near the top of the same stems, and which are nearly as strongly marked. The trunk has undergone, then, no considerable change or increase in its diameter; nor any remarkable alteration in the state of its surface, towards

the base. These views confirm the remark which has been here already made, respecting the singular maintenance in size, of the diameter of the Sigillaires of our own coal fields.

Respecting the class of plants to which these enormous trunks appertained, we have good authority for placing them among the numerous families of the group of ferns. It is impossible, M. Brongniart contends, to admit that these stems had belonged to vegetables of the class of dicotyledons. No wood of dicotyledonous or monocotyledonous plants, properly speaking, have been found in the coal fields; nor is there any dicotyledonous plant, actually existing, which shows stems regularly grooved, and bearing the organs, which, after their fall, leave cicatrices at all analogous to those of the Sigillaires. The ancient surface, therefore, during the growth of our Pennsylvania coal strata, was overshadowed by groves of gigantic ferns, rivalling in magnitude the trees of our present forests.\*

#### THE NORTH WALL, OR ROOF.

We turn now to the examination of the north wall, or rock roof, of our coal seam. Here an entirely different aspect presents itself; well worth the recital. Instead of an interlaced mass, composed of innumerable thinly compressed and flattened stems, displayed upon a comparatively smooth surface of black clay shale, we have a series of long bifurcating columns whose dark forms are relieved against the lighter coloured conglomerate. We are struck with the fact, that unlike those on the opposite wall, excepting in one species, none of these stems are straight: they all possess remarkable curvatures. Their bark, originally very thin, and since converted into coaly laminæ, readily falls away under the operations of the miner. Much was probably destroyed at a vastly older period amidst the turbulence which attended their prostration. Of this we have some evidence in the occasional marks of rubbing which some of these stems appear to have received. Both circumstances contribute to the difficulty of identifying the species.

All these trees appear to belong not only to one genus, but to a single species. Less numerous—inasmuch as they indicate such only as lived at that remarkable epoch, when the diluvial waters, heaving along enormous masses of sand, and gravel and pebbles, swept over the surface,—less numerous, I say, than that earlier vegetation, which slowly and quietly accumulated at the base of the coal, in the position we have just been considering them,—these prostrated overlying trunks, present even a more interesting spectacle. Seldom has it occurred to witness an exhibition of antediluvian vegetation, like this, of which we have given but an imperfect sketch.

Facilitated by the gradual advance of the work, under his immediate direction, the writer had abundant leisure for observing these remains; and opportunities were not lost to prepare a faithful picture of the most interesting. Ample as apparently were the

\* The clay floor of the coal, bearing these magnificent traces of tropical vegetation, exhibits, when broken, in its interior, the grass-like leaves of Lycopodiolite, and Stigmara. One of the family of Sigillaria, also, (*S. Lepidendri-folia*;) bears leaves which are not greatly dissimilar to those of the former. Leaves of the other and smaller ferns, are not very frequent here. Stigmara is less abundant than usual in other seams, and has contributed but little towards the composition of the mass of coal.

means of observation, afforded by the excavations, yet such is the magnitude of each individual specimen, that we have again to regret the want of additional space to enable the examination to be followed up satisfactorily. Fortunately, in one or two instances we are enabled to approximate to the probable length of the stems, although in neither case are we sure of the exact character of their terminations. Believing that the absence of more complete data is an insufficient reason for withholding so much as we really do know, I have not scrupled to prepare this memoir.

One of the instances adverted to, a dichotomous specimen, has a remarkable flexuous stem. It would be hazarding too much to guess at its probable length; for both extremities are concealed. Not less than sixty-five feet, however, in extent, is clearly visible. For aught that can be inferred from its present appearance, this tree may have extended thirty or forty feet still longer. The other specimen, the most interesting, in fact, of the group, shows its lower extremity, near what might have been the root. For the first forty feet there is but little diminution or tapering;—perhaps about six inches: so that our admeasurements give, in that distance, an average thickness of two feet. Like the others with which it is associated, this trunk is flexuous; but is least so towards its superior part, for the last forty feet. Seventy feet of this fine stem are exposed within the limits of our drawing—we followed it several feet in the coal shale below the level surface without discovering any sign of termination. The specimens exhibited on the society's table were taken from that concealed portion. We may venture to assign a height of this tree of from eighty to one hundred feet. During the greatest portion of its entire length, a central longitudinal groove or depression appears, somewhat after the manner of some *Stigmarias* and *Lepidodendrons*. Like the other cases previously alluded to, such portions of the carbonized bark as remained on the trunk or mould, were extremely thin; readily scaling off, when dry. This bark was not more than from  $\frac{1}{25}$  to  $\frac{1}{30}$  of an inch in thickness. No traces of any other, or second bark, externally, has been observed in any specimen. A third trunk appears near the entrance to the gallery: this specimen exhibits more than fifty feet now uncovered, by coal or slate; we might judge, from its appearance, that it extended thirty or forty feet farther.

It is necessary to mention, that none of these trunks were in the extremely compressed state, such as is exhibited in those on the bottom slate. They occur as casts, filled with indurated clay. When fractured they break in rhomboids, whose acute angle is forty-three degrees. Longitudinal flutings are visible throughout the length of these stems, and obscure marks of cicatrices, of the smallest class, are of general occurrence.

There now remains only the important inquiry, under what class and family should these magnificent trunks be arranged? In the midst of certain obvious difficulties, we have not scrupled to class these dichotomous stems with the *Sigillaires*, and in that division which is now admitted among the tree ferns. We have even ventured to refer them to *Sigillaires elegans* or *hexagona*. With respect to the *Sigillariæ* which have bifurcations, M. Brongniart admits that they are confined to a single species, which species is the *Sigillaria elegans*. In this he is corroborated by M. Graeser, director of mines, who asserts that this character is frequent in that species.

With regard to the general form of the trunks of *Sigillaria*, their height, and their mode of termination, there is still very incomplete data. We have rarely had occasion



to follow these stems to a great extent. However, in the mine of Kunzwerk, M. Brongniart was able to measure one stem of *Sigillaria*, which laid parallel to the gallery of extraction; which stem was more than forty feet long. This stem diminished insensibly, from the base where it was one foot thick, to near the summit where it was only six inches, and there divided into two equal branches. I am not aware, that any fossil trees from the coal measures have ever been described, which at all approached to the dimensions of our Pennsylvania *Sigillaria*.

Respecting the admission of the *Sigillaires* into the family of the ferns, we have seen that Messrs. Lindley and Hutton entertain somewhat different views from M. Brongniart. We have stated, with great brevity, the reasons which induce the last named naturalist to adhere to his classification; at the same time, to include therein one section under the name of *Caulopteris*, containing four species of undoubted arborescent ferns, and they are strikingly analogous to those which still actually exist. Of these four fossil arborescent ferns, one species, the *Sigillaire Cistii*, exists in the Coal Strata of Wilkesbarre, in this State. Fifty-five species of *Sigillaria*, besides the four of *Caulopteris*, occupy the coal formation. Many of these, perhaps all, are common both to Europe and to America.

That investigation has still to be followed up. On one point all are agreed:—that all the fossil plants, of whatever class, attained a magnitude vastly more considerable than the largest existing analogous species.

From the rocky covering of this and one or two adjacent coal seams, I have obtained specimens of *Lycopodium elegans*; one or two uncertain casts of *Sigillaria*; *Knorria imbricata*?; *Stigmaria ficoides*; *Lepidodendron*, two species; besides carbonized leaves and impressions of *Lycopodiolites*, in the grits and sandstones. *Calamites* are rare in this vicinity.

The discovery, not long ago announced by Mr. Logan, that the plant *Stigmaria* characterized, and almost universally prevailed in, the under clay of argillaceous floors of the coal seams of Europe, seems to hold good on this continent. On examination, any one can perceive that our lower shales, on which coal beds rest, are crowded with the stems and leaves of this singular plant. It was, however, further maintained that the floors alone, and not the roofs, contain the vestiges of these vegetables. I have not had much subsequent opportunity of satisfying myself on the latter point, since its announcement; but I think it is extremely probable: and that, in a great measure, the phenomena here agree with those developed by the European naturalist.

The drawing which accompanies this paper, and all the notes respecting the fossil plants, which were exhibited on seven or eight thousand square feet, having been completed prior to that announcement, I was desirous to see how far they were in conformity with Mr. Logan's system.

On examining this drawing, we shall perceive that only two specimens of *Stigmaria* occur in the entire length of the gallery. One of them is above the coal, on the north wall; the other is below the coal, on the south wall. This is certainly not a very satisfactory corroboration; but the plant overlying the coal may be a solitary individual, connected originally with the thin slaty covering of the coal: as, however, it appears by the sketch to have some of its leaves in close proximity, if not in direct contact with the stem, it has evidently not been removed from a distance, into the position in which we

observe it. It probably had been rooted in the thin slate seam, between the coal and the rock. A siliceous cast of a second *stigmara*, apparently of another species, was obtained from the sandstone above. As similar sandstone casts of *Stigmara* are among the commonest fossils found among the superficial debris of this carboniferous region, it can scarcely be maintained, with strict propriety, that these plants are limited to the soft argillaceous beds upon which the coal seams repose. Time and extended observation will determine the value of the rule. It will then perhaps be found that every bed of clay, embraced within the true limits of coal fields, contains a greater or less amount of these exuviae; such clay being the natural position in which they grew and were sustained.

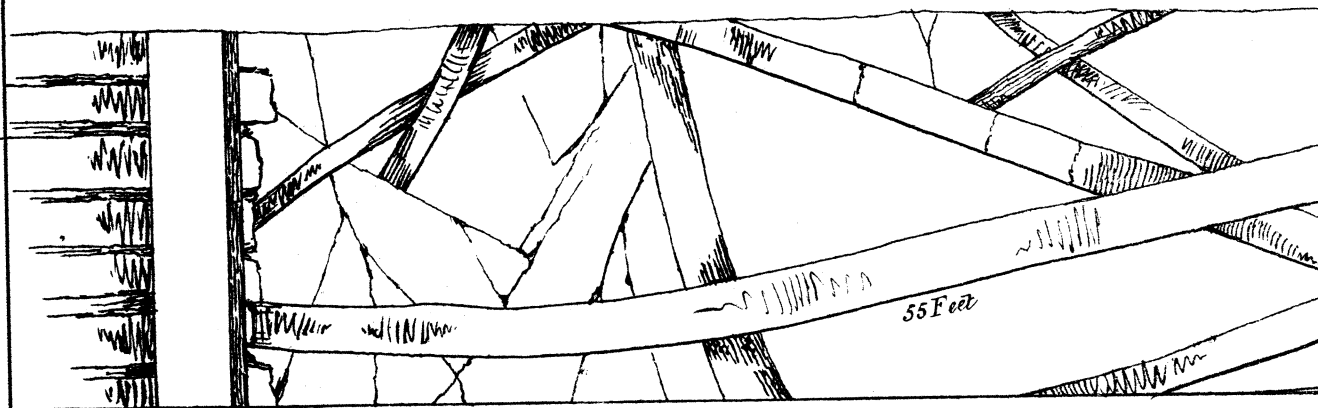
The following are the principal fossil plants referred to in the foregoing article. It is avowedly very incomplete;—an approximation, merely; and many are omitted.

## PLANTS IN THE ROOF OF THE COAL SEAM.

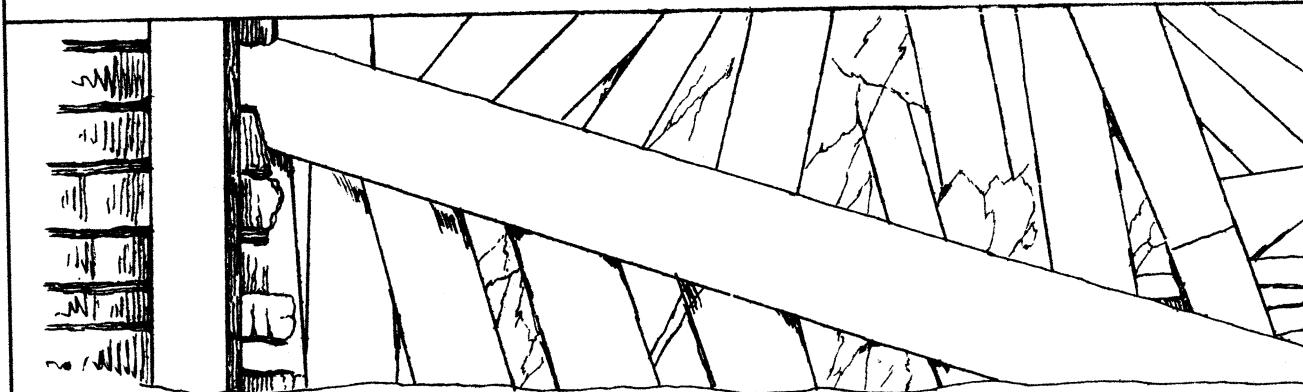
<i>Sigillaria elegans</i> , . . . . .	A. Brongniart pl. 146,—and pl. 158, fig. 1.
<i>Stigmara ficoides</i> , . . . . .	Sternberg Tab. xii., also, some leaves.
<i>Lycopodiolites elegans</i> , . . . . .	“ Tab. xvi., sandstone cast.
<i>Knorria imbricata</i> , . . . . .	“ Tab. xxvii., sandstone above the conglomerate.
<i>Lepidodendron</i> —?—smaller than <i>L. obovatum</i> ,	“ Tab. vi., cast in sandstone.
“ “ <i>Volkmannianum</i> , . . . . .	“ Tab. liii., f. 3.

## PLANTS IN THE UNDER CLAY OR FLOOR.

<i>Sigillaria elegans</i> , . . . . .	A. Brongniart, pl. 146, 158.
“ <i>elongata</i> ? . . . . .	“ pl. 145, doubtful.
“ <i>lævigata</i> , . . . . .	“ pl. 143, $\frac{1}{3}$ d larger than Brongniart's fig.
“ <i>pachydermata</i> ? . . . . .	“ pl. 150, 2.
“ <i>reniformis</i> ? . . . . .	“ pl. 142, doubtful.
<i>Syringodendron</i> ? . . no cicatrices visible, .	Sternberg.
<i>Stigmara ficoides</i> , . . . . .	“ Tab. xii., with leaves in contact.
<i>Sphenopteris delicatula</i> , . . . . .	A. Brongniart pl. 58, fire clay outcrop.
“ <i>elegans</i> , . . . . .	Sternberg Tab. xx, 3, 4, (second index,) Da.
<i>Lepidodendron Volkmannianum</i> , . . . . .	Sternberg Tab. liii., f. 3.
“ <i>rimosum</i> , . . . . .	“ Tab. x., very thick bark.
<i>Nevropteris plicata</i> , . . . . .	“ Tab. xix., (second series.)
“ <i>Loshii</i> , . . . . .	A. Brongniart pl. 73, fire clay outcrop.
<i>Pecopteris long chitica</i> ? . . . . .	“ pl. 84 and 128, outcrop.
“ <i>miltoni</i> ? . . . . .	“ pl. 114, outcrop.
“ <i>cyathea</i> , . . . . .	“ pl. 101, “
<i>Calamites Cistii</i> , . . . . .	“ pl. 20, “

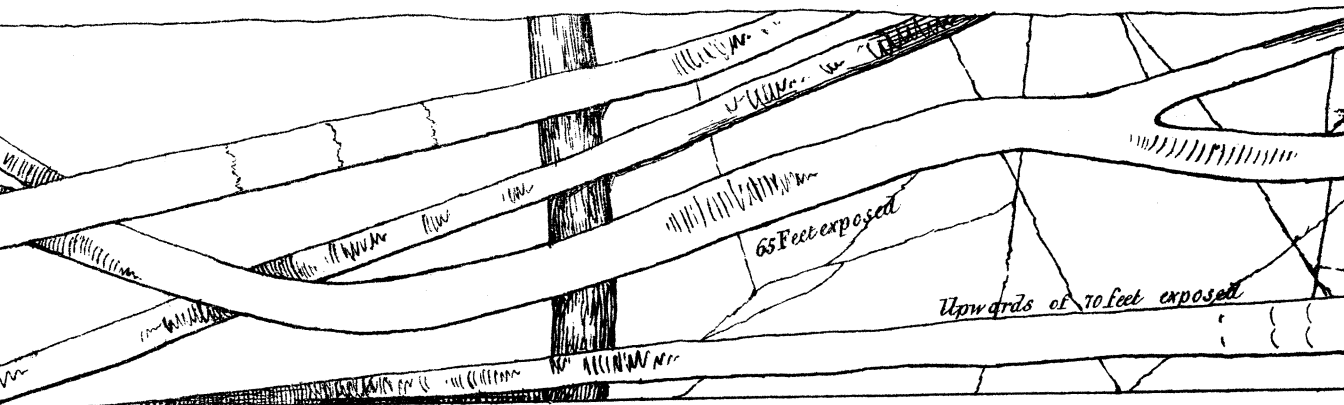


**GALLERY OR GANGWAY** *between the Walls of the Vein. Nine feet wide*



*Lepidodendron rimosum ?*

# FOSSIL SIGILLARIA AND OTHER



THE

ine feet wide... Course varies from N 64°½ to 71° E. having about 3 Feet of Central Slate.

THE FLOOR O

*Sigillaria elegans*

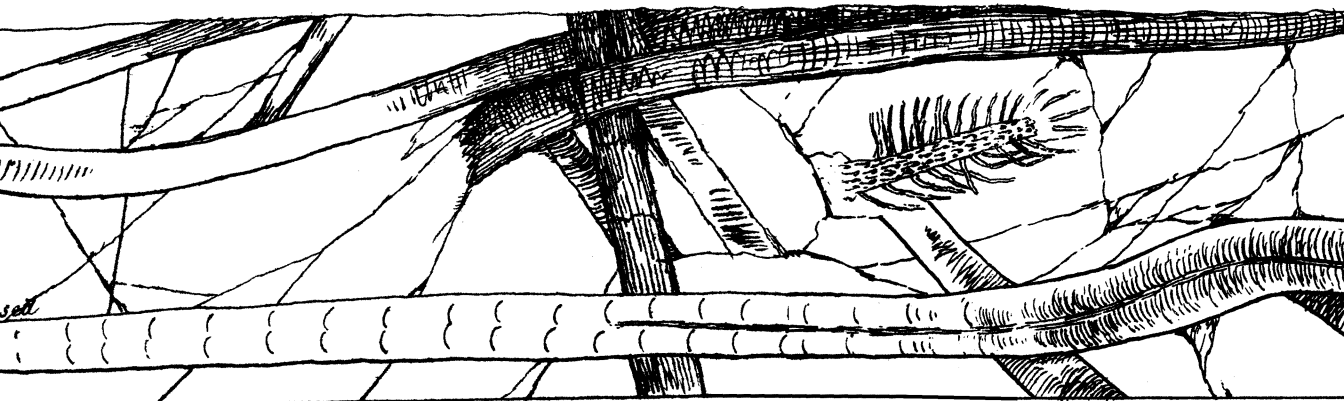


*Sigillaria elegans* ?

AND OTHER COAL PLANTS IN THE ROOF AND

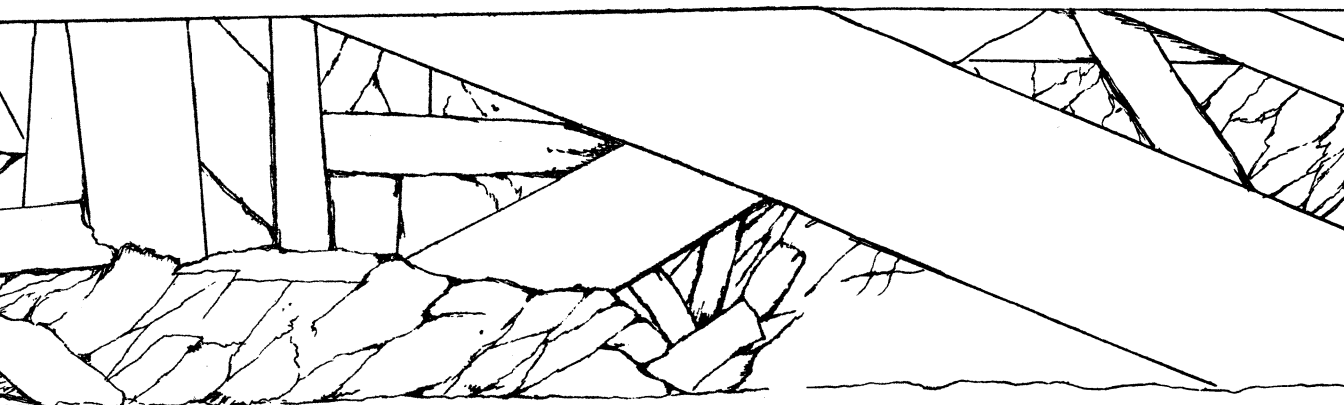
FLOOR OF THE PERSEVERANCE

*Stigmaria ficioides*



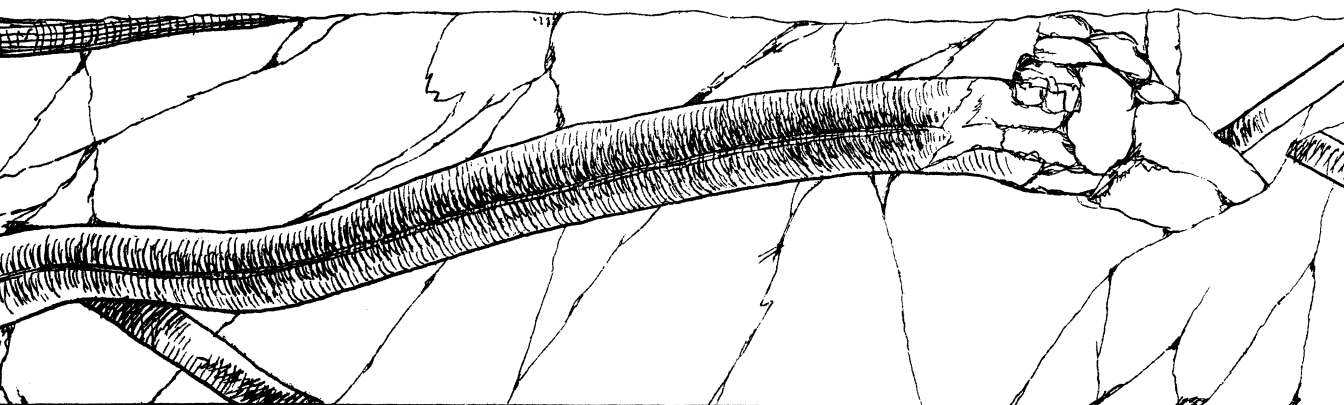
THE ROOF OR NORTH WALL, CONSISTING OF CONGLOMERATE OR PUDDINGSTONE, D

FLOOR OR SOUTH WALL OF CLAY SLATE AND FIRE CLAY.

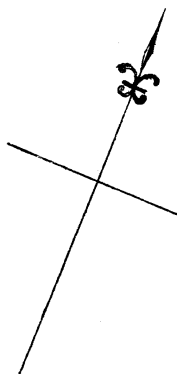


*Stigmaria*  
41

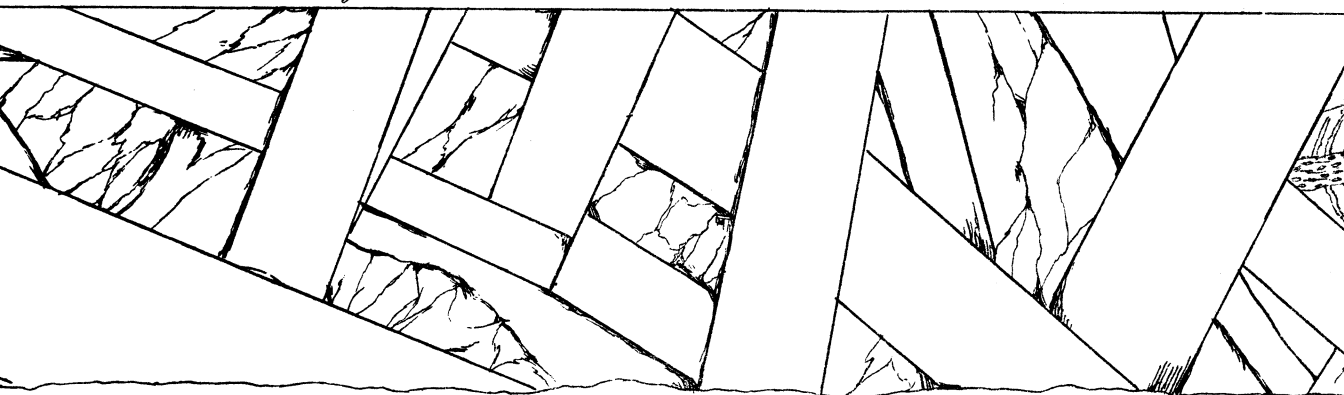
FRANCE COAL SEAM, IN DAUPHIN CO. PENN<sup>a</sup>



STONE, DIPPING 70° TO NORTH.



*Sigillaria  
elongata*

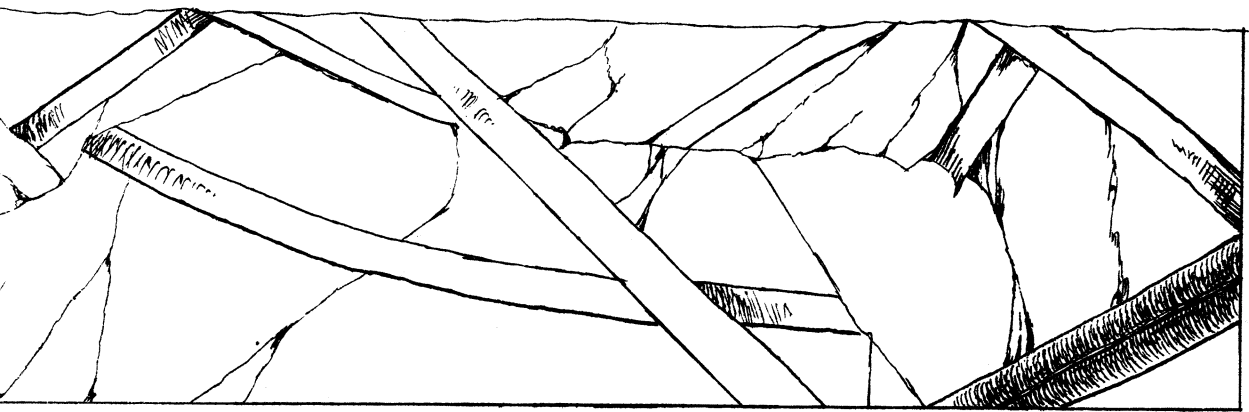


*Sigillaria reniformis?*  
4 feet wide

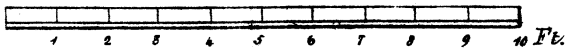
*Lepidodendron  
rimosum?*

3 feet wide

*Sigillaria  
Pachydermata*



Scale of feet.



*Stigmara fissoides*



*Sigillaria*  
*achyodermata?*

*Lepidodendron*  
*Volkmannianum*

*Sigillaria*  
*laevigata*

*Lepidodendron* *rimosum?*

To illustrate M.R.C. Taylors Paper in the Trans. Phil. Soc. of Am.